REMARKS/ARGUMENTS

Drawings Objection

The drawings filed on April 13, 2001 are objected to because of draftperson's remarks per PTO-948 attached to the Office action mailed 12/22/2004.

The applicants have filed the formal drawings herewith in order to overcome the drawings objection. Approval of the formal drawings is requested.

Specification Objection

The abstract is objected to because the legal phraseology "said" is used on multiple occasions.

The applicants have amended the abstract in order to overcome the objection. Furthermore, the applicants have amended the **"CROSS-REFERENCE TO RELATED APPLICATIONS"** section in the specification to provide US patent numbers for patents issued from the patent applications cited therein. No new matter has been added through these amendments to the specification. Approval of the specification amendments is requested.

Claims

Claims 1-20 and 33-60 are pending in the application. Claims 1-20, 33-36 and 41-60 stand rejected on the prior art grounds. Claims 37-40 are objected to as being dependent upon a rejected base claim, but would be allowable if written in independent form including all of the limitations of the base claim and any intervening claims. In order to overcome the rejections, the applicants have amended claims 1, 3, 5-8, 33, 43, 48 and 50-53 and canceled claims 2, 4, 20, 47 and 49. Please enter amended claims 1, 3, 5-8, 33, 43, 48 and 50-53.

35 USC § 102 Rejections

Claims 1-5, 7, 9, 13, 14, 18, 19, 33, 36, 42, 43, 46-50, 52-54 and 58-60

The Examiner has rejected claims 1-5, 7, 9, 13, 14, 18, 19, 33, 36, 42, 43, 46-50, 52-54 and 58-60 under 35 U.S.C. 102(e) as being anticipated by USPN 6,476,803 to Zhang et al. ("Zhang").

Regarding claim 1, the applicants have amended independent method claim 1 to overcome the Examiner's rejection and distinguish it from Zhang. The amended independent claim 1 reads:

> Claim 1. (currently amended) A method of constructing a virtual three-dimensional model of an object from a scanner, a data processing system, and at least one machine-readable memory accessible to said data processing system, comprising the steps of:
>
> (a) scanning the object with the scanner and thereby obtaining at least two two-dimensional images of the object, wherein during scanning the scanner and object are moved relative to each other resulting in each image being taken from a different position relative to the surface of the object;
>
> (b) processing said data representing said set of images with said data processing system so as to convert each of said two-dimensional images into data representing a frame and thereby generate a set of frames corresponding to said images, said set of frames comprising a cloud of individual points, each point in each frame expressed as a location in a three-dimensional X, Y, and Z coordinate system;
>
> (c) storing data representing said set of frames in said memory; and
>
> (d) further processing said data representing said set of frames with said data processing system so as to register said frames relative to each other using a frame to frame registration process to thereby produce a three-dimensional virtual model of the object substantially consistent with all of said frames; said frame to farme registration process comprising the steps of:
>
> (i) performing an initialization step comprising the sub-steps of:
>
> (A) selecting one of the frames from said set of frames as the first frame;
>
> (B) ordering said set of frames in a sequence of frames $Frame_i$ for i = 1 to N for further processing, wherein $Frame_1$ is the first frame;

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(C) setting a quality index for evaluating the quality of the overall registration of one frame to another frame;

(D) setting the frame subscript value i = 2; and

(E) selecting $Frame_{i-1}$ and $Frame_i$ for registering $Frame_i$ to $Frame_{i-1}$;

(ii) transforming the Z coordinate of every point in $Frame_i$, thereby bringing $Frame_i$ closer to $Frame_{i-1}$, comprising the sub-steps of:

(A) calculating for $Frame_{i-1}$: (1) the sum of all Z coordinates $Z_{sum\ i-1}$ = sum of the Z coordinate of every point in $Frame_{i-1}$; and (2) the median Z coordinate $Z_{median\ i-1} = Z_{sum\ i-1}$ divided by the number of points in $Frame_{i-1}$;

(B) calculating for $Frame_i$: (1) the sum of all Z coordinates $Z_{sum\ i}$ = sum of the Z coordinate of every point in $Frame_i$; and (2) the median Z coordinate $Z_{median\ i} = Z_{sum\ i}$ divided by the number of points in $Frame_{i;}$ and

(C) calculating $\Delta Z = Z_{median\ i} - Z_{median\ i-1}$; subtracting ΔZ from the Z coordinate of every point in $Frame_i$, thereby transforming the Z coordinate of every point in $Frame_i$, and setting $Frame_i = Frame_i$ having the transformed Z coordinates.

(iii) calculating the translation matrix for $Frame_i$ comprising the sub-steps of:

(A) calculating a minimum distance vector from every point in $Frame_i$ to the surface of $Frame_{i-1,}$ thereby creating a set of minimum distance vectors for $Frame_i$;

(B) eliminating from said set of minimum distance vectors for $Frame_i$ each of said set of minimum distance vector for $Frame_i$ that satisfies one or more exclusion criteria from a set of exclusion criteria, thereby creating a remaining set of minimum distance vectors for $Frame_i$, and marking each of the points corresponding to the remaining set of minimum distance vectors for $Frame_i$ as an overlapping point, wherein said overlapping points define the area of overlap between $Frame_{i-1}$ and $Frame_i$;

(C) calculating a vector sum of minimum distance vectors for $Frame_i$ by summing all minimum distance vectors corresponding to said overlapping points in $Frame_i$; and

(D) calculating a median minimal distance vector $(t)_i$ for $Frame_i$ by dividing the vector sum of minimum distance vectors for $Frame_i$ with the number of vectors corresponding to said overlapping points in $Frame_i$ thereby the median minimal distance vector $(t)_i$ for $Frame_i$ forming the translation matrix $[T](t)_i$;

(iv) calculating the rotation transformation matrix for $Frame_i$ comprising the sub-steps of:

(A) creating a copy of $Frame_i$, and designating said copy of $Frame_i$ $Frame_{i*}$;

(B) subtracting the median minimal distance vector $(t)_i$ from every point in $Frame_{i*}$;

(C) gettng a position vector for every overlapping point in $Frame_{i*}$ extending from the origin of the coordinate system for $Frame_{i*}$ to the overlapping point in $Frame_{i*}$;

(D) calculating a vector sum of all position vectors corresponding to all of the overlapping points in $Frame_{i*}$;

(E) calculating the center of mass for $Frame_{i*}$ by dividing the vector sum of all position vectors corresponding to all of the overlapping points in $Frame_{i*}$ with the number of said position vectors corresponding to all of said overlapping points in $Frame_{i*}$;

(F) calculating a cross-vector for every overlapping point in $Frame_{i*}$ by performing a cross-product operation of (1) the position vector for the overlapping point in $Frame_{i*}$ substracted by the vector of the center of mass for $Frame_{i*}$ and (2) said minimum distance vector for the overlapping point in $Frame_{i*}$;

(G) calculating a sum of all the cross-vectors corresponding to all of the overlapping points in $Frame_{i*}$;

(H) applying a weighting factor to the sum of all of said cross-vectors for $Frame_{i*}$ thereby producing a weighted sum of all the cross-vectors for $Frame_{i*}$; and

(I) scaling the weighted sum of all the cross-vectors for $Frame_{i*}$ with an empirical acceleration factor f thereby creating a scaled weighted sum of all the cross-vectors for $Frame_{i*}$ thereby said scaled weighted sum of all the cross-vectors for $Frame_{i*}$ forming the rotation transformation matrix $[T](R)_i$.

(v) applying the transformation to $Frame_i$ and evaluating the results comprising the sub-steps of:

(A) computing the transformation matrix for $Frame_i$ $[T]_i = + [T](t)_i + [T](R)_i$; and applying the transformation matrix $[T]_i$ to every point in $Frame_i$ thereby producing a transformed $Frame_i$ wherein $[T](t)_i$ produces the transalation of the X, Y and Z coordinates of every point in $Frame_i$ and $[T](R)_i$ produces the magnitude and direction of rotation of $Frame_i$;

(B) calculating the closeness factor of the transformed $Frame_i$ and $Frame_{i-1}$ and comparing said closeness factor with the quality index;

(C) if the closeness factor > the quality index, then returning to step (iii); otherwise proceeding to the next step;

(D) if $i < N$, setting $i = i + 1$ and returning to step (ii) until $Frame_N$ is registered.

The method claim 1 has been amended to disclose in detail a very important aspect of constructing a virtual three-dimensional model of an object from frames derived from the scanned image of the object, namely the process of frame to frame registration in the sub-steps of step (d). The novel sub-steps provide the details concerning (i) transformation of the Z coordinates, (ii) calculation of the translation matrix, (iii) calculation of the rotation transformation matrix; and their application in transforming a frame for registering it to another frame. The support for the amendment to claim 1 comes from page 65, line1 - page 73, line 3 and Figures 40A - 40D of the specification. In order to fully appreciate the novelty of frame to frame registration as a very important component of constructing a virtual three-dimensional model of an object one must examine the detailed sub-steps of amended claim 1. Zhang does not teach or disclose the registration process used in constructing a virtual three-dimensional model of an object disclosed in claim 1. The applicants submit that amended independent claim 1 is novel over and not anticipated by Zhang.

In view of the above remarks, the anticipation rejection under 35 U.S.C. 102(e) of claim 1 should be withdrawn.

Regarding claim 2, the applicants have canceled claim 2.

Regarding claim3, claim 3 depends from independent claim 1. Applicants have amended claim 3 in view of the amendment to claim 1. The applicants respectfully submit that in view of the amendment to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the anticipation rejection under 35 U.S.C. 102(e) of claim 3 are moot; and request that the anticipation rejection under 35 U.S.C. 102(e) of claim 3 should be withdrawn.

Regarding claim 4, the applicants have canceled claim 4.

Regarding claims 5, 7, 9, 13, 14, 18 and 19, each of claims 5, 7, 9, 13, 14, 18 and 19 depends from independent claim 1. Applicants have amended claim 5 and 7 in view of the amendment to claim 1. The applicants respectfully submit that in view of the amendment to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the anticipation rejection under 35 U.S.C. 102(e) of claims 5, 7, 9, 13, 14, 18 and 19 are moot; and request that the anticipation rejection under 35 U.S.C. 102(e) of claims 5, 7, 9, 13, 14, 18 and 19 should be withdrawn.

Regarding claim 33, the applicants have amended independent method claim 33 to overcome the Examiner's rejection and distinguish it from Zhang. The amended independent claim 33 reads:

Claim 33. (original) A method of creating a virtual three-dimensional object, comprising the steps of:

a) scanning said object in a series of scans, each scan generating a set of images;

b) converting said set of images into a set of three-dimensional frames;

c) registering said frames in each of said series of scans to each other using a frame to frame registration process to thereby generate a series of segments, each segment comprising a portion of a three-dimensional model of the object; said frame to frame registration process comprising the steps of:

(i) performing an initialization step comprising the sub-steps of:

(A) selecting one of the frames from said set of frames as the first frame;

(B) ordering said set of frames in a sequence of frames $Frame_i$ for $i = 1$ to N for further processing, wherein $Frame_1$ is the first frame;

(C) setting a quality index for evaluating the quality of the overall registration of one frame to another frame;

(D) setting the frame subscript value $i = 2$; and

(E) selecting $Frame_{i-1}$ and $Frame_i$ for registering $Frame_i$ to $Frame_{i-1}$;

(ii) transforming the Z coordinate of every point in $Frame_i$, thereby bringing $Frame_i$ closer to $Frame_{i-1}$, comprising the sub-steps of:

(A) calculating for $Frame_{i-1}$: (1) the sum of all Z coordinates $Z_{sum\ i-1}$ = sum of the Z coordinate of every point in $Frame_{i-1}$; and (2) the median Z coordinate $Z_{median\ i-1} = Z_{sum\ i-1}$ divided by the number of points in $Frame_{i-1}$;

(B) calculating for $Frame_i$: (1) the sum of all Z coordinates $Z_{sum\ i}$ = sum of the Z coordinate of every point in $Frame_i$; and (2) the median Z coordinate $Z_{median\ i} = Z_{sum\ i}$ divided by the number of points in $Frame_i$; and

(C) calculating $\Delta Z = Z_{median\ i} - Z_{median\ i-1}$; subtracting ΔZ from the Z coordinate of every point in $Frame_i$, thereby transforming the Z coordinate of every point in $Frame_i$, and setting $Frame_i$ = $Frame_i$ having the transformed Z coordinates.

(iii) calculating the translation matrix for $Frame_i$ comprising the sub-steps of:

(A) calculating a minimum distance vector from every point in $Frame_i$ to the surface of $Frame_{i-1}$, thereby creating a set of minimum distance vectors for $Frame_i$;

(B) eliminating from said set of minimum distance vectors for $Frame_i$ each of said set of minimum distance vector for $Frame_i$ that satisfies one or more exclusion criteria from a set of exclusion criteria, thereby creating a remaining set of minimum distance vectors for $Frame_i$, and marking each of the points corresponding to the remaining set of minimum distance vectors for $Frame_i$ as an overlapping point, wherein said overlapping points define the area of overlap between $Frame_{i-1}$ and $Frame_i$;

(C) calculating a vector sum of minimum distance vectors for $Frame_i$ by summing all minimum distance vectors corresponding to said overlapping points in $Frame_i$; and

(D) calculating a median minimal distance vector $(t)_i$ for $Frame_i$ by dividing the vector sum of minimum distance vectors for $Frame_i$ with the number of vectors corresponding to said overlapping points in $Frame_i$ thereby the median minimal distance vector $(t)_i$ for $Frame_i$ forming the translation matrix $[T](t)_i$;

(iv) calculating the rotation transformation matrix for $Frame_i$ comprising the sub-steps of:

(A) creating a copy of $Frame_i$, and designating said copy of $Frame_i$ $Frame_{i*}$;

(B) subtracting the median minimal distance vector $(t)_i$ from every point in $Frame_{i*}$;

(C) gettng a position vector for every overlapping point in $Frame_{i*}$ extending from the origin of the coordinate system for $Frame_{i*}$ to the overlapping point in $Frame_{i*}$;

(D) calculating a vector sum of all position vectors corresponding to all of the overlapping points in $Frame_{i*}$;

(E) calculating the center of mass for $Frame_{i*}$ by dividing the vector sum of all position vectors corresponding to all of the overlapping points in $Frame_{i*}$ with the number of said position vectors corresponding to all of said overlapping points in $Frame_{i*}$;

(F) calculating a cross-vector for every overlapping point in $Frame_{i*}$ by performing a cross-product operation of (1) the position vector for the overlapping point in $Frame_{i*}$ substracted by the vector of the center of mass for $Frame_{i*}$ and (2) said minimum distance vector for the overlapping point in $Frame_{i*}$;

(G) calculating a sum of all the cross-vectors corresponding to all of the overlapping points in $Frame_{i*}$;

(H) applying a weighting factor to the sum of all of said cross-vectors for $Frame_{i*}$ thereby producing a weighted sum of all the cross-vectors for $Frame_{i*}$; and

(I) scaling the weighted sum of all the cross-vectors for $Frame_{i*}$ with an empirical acceleration factor f thereby creating a scaled weighted sum of all the cross-vectors for $Frame_{i*}$ thereby said scaled weighted sum of all the cross-vectors for $Frame_{i*}$ forming the rotation transformation matrix $[T](R)_i$.

(v) applying the transformation to $Frame_i$ and evaluating the results comprising the sub-steps of:

(A) computing the transformation matrix for $Frame_i$ $[T]_i = + [T](t)_i + [T](R)_i$; and applying the transformation matrix $[T]_i$ to every point in $Frame_i$ thereby producing a transformed $Frame_i$ wherein $[T](t)_i$ produces the transalation of the X, Y and Z coordinates of every point in $Frame_i$ and $[T](R)_i$ produces the magnitude and direction of rotation of $Frame_i$;

(B) calculating the closeness factor of the transformed $Frame_i$ and $Frame_{i-1}$ and comparing said closeness factor with the quality index;

(C) if the closeness factor > the quality index, then returning to step (iii); otherwise proceeding to the next step;

(D) if $i < N$, setting $i = i + 1$ and returning to step (ii) until $Frame_N$ is registered.

and

d) registering said segments relative to each other to thereby create said virtual three-dimensional model.

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The applicants' remarks in support of amended claim 33 are analogous to those presented in support of claim 1. The method claim 33 has been amended to disclose in detail a very important aspect of creating a virtual three-dimensional model of an object from frames derived from the scanned image of the object, namely the process of frame to frame registration in the sub-steps of step (c). The novel sub-steps provide the details concerning (i) transformation of the Z coordinates, (ii) calculation of the translation matrix, (iii) calculation of the rotation transformation matrix; and their application in transforming a frame for registering it to another frame. The support for the amendment to claim 33 comes from page 65, line1 - page 73, line 3 and Figures 40A - 40D of the specification. In order to fully appreciate the novelty of frame to frame registration as a very important component of constructing a virtual three-dimensional model of an object one must examine the detailed sub-steps of amended claim 33. Zhang does not teach or disclose the registration process used in creating a virtual three-dimensional model of an object disclosed in claim 33. The applicants submit that amended independent claim 33 is novel over and not anticipated by Zhang.

In view of the above remarks, the anticipation rejection under 35 U.S.C. 102(e) of claim 33 should be withdrawn.

Regarding claims 36 and 42, each of claims 36 and 42 depends from independent claim 33. The applicants respectfully submit that in view of the amendment to independent claim 33 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 33, the Examiner's grounds for the anticipation rejection under 35 U.S.C. 102(e) of claims 36 and 42 are moot; and request that the anticipation rejection under 35 U.S.C. 102(e) of claims 36 and 42 should be withdrawn.

Regarding claim 43, the applicants have amended independent method claim 43 to overcome the Examiner's rejection and distinguish it from Zhang. The amended

independent claim 43 reads:

Claim 43. (currently amended) A method of constructing a virtual three-dimensional model of an object using a data processing system, and at least one machine-readable memory accessible to said data processing system, comprising the steps of:

(a) obtaining a set of at least two digital three-dimensional frames of portions of the object, wherein said at least two frames comprise a set of point coordinates in a three dimensional coordinate system providing differing information of the surface of said object, whereas those frames provide a substantial overlap of the represented portions of the surface of the said object;

(b) storing data representing said set of frames in said memory; and

(c) processing said data representing said set of frames with said data processing system so as to register said frames relative to each other using a frame to frame registration process to thereby produce a three-dimensional virtual representation of the portion of the surface of said object covered by said set of frames, without using pre-knowledge about the spatial relationship between said frames; said three-dimensional virtual representation being substantially consistent with all of said frames; said frame to frame registration process comprising the steps of:

(i) performing an initialization step comprising the sub-steps of:

(A) selecting one of the frames from said set of frames as the first frame;

(B) ordering said set of frames in a sequence of frames Frame_i for i = 1 to N for further processing, wherein Frame_1 is the first frame;

(C) setting a quality index for evaluating the quality of the overall registration of one frame to another frame;

(D) setting the frame subscript value i = 2; and

(E) selecting Frame_{i-1} and Frame_i for registering Frame_i to Frame_{i-1};

(ii) transforming the Z coordinate of every point in Frame_i, thereby bringing Frame_i closer to Frame_{i-1}, comprising the sub-steps of:

(A) calculating for Frame_{i-1}: (1) the sum of all Z coordinates $Z_{\text{sum } i-1}$ = sum of the Z coordinate of every point in Frame_{i-1}; and (2) the median Z coordinate $Z_{\text{median } i-1} = Z_{\text{sum } i-1}$ divided by the number of points in Frame_{i-1};

(B) calculating for Frame_i: (1) the sum of all Z coordinates $Z_{\text{sum } i}$ = sum of the Z coordinate of every point in Frame_i; and (2) the median Z coordinate $Z_{\text{median } i} = Z_{\text{sum } i}$ divided by the number of points in Frame_i; and

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(C) calculating $\Delta Z = Z_{median\ i} - Z_{median\ i-1}$; subtracting ΔZ from the Z coordinate of every point in $Frame_i$, thereby transforming the Z coordinate of every point in $Frame_i$, and setting $Frame_i = Frame_i$ having the transformed Z coordinates.

(iii) calculating the translation matrix for $Frame_i$ comprising the sub-steps of:

(A) calculating a minimum distance vector from every point in $Frame_i$ to the surface of $Frame_{i-1}$, thereby creating a set of minimum distance vectors for $Frame_i$;

(B) eliminating from said set of minimum distance vectors for $Frame_i$ each of said set of minimum distance vector for $Frame_i$ that satisfies one or more exclusion criteria from a set of exclusion criteria, thereby creating a remaining set of minimum distance vectors for $Frame_i$, and marking each of the points corresponding to the remaining set of minimum distance vectors for $Frame_i$ as an overlapping point, wherein said overlapping points define the area of overlap between $Frame_{i-1}$ and $Frame_i$;

(C) calculating a vector sum of minimum distance vectors for $Frame_i$ by summing all minimum distance vectors corresponding to said overlapping points in $Frame_i$; and

(D) calculating a median minimal distance vector $(t)_i$ for $Frame_i$ by dividing the vector sum of minimum distance vectors for $Frame_i$ with the number of vectors corresponding to said overlapping points in $Frame_i$ thereby the median minimal distance vector $(t)_i$ for $Frame_i$ forming the translation matrix $[T](t)_i$;

(iv) calculating the rotation transformation matrix for $Frame_i$ comprising the sub-steps of:

(A) creating a copy of $Frame_i$, and designating said copy of $Frame_i$ $Frame_{i*}$;

(B) subtracting the median minimal distance vector $(t)_i$ from every point in $Frame_{i*}$;

(C) gettng a position vector for every overlapping point in $Frame_{i*}$ extending from the origin of the coordinate system for $Frame_{i*}$ to the overlapping point in $Frame_{i*}$;

(D) calculating a vector sum of all position vectors corresponding to all of the overlapping points in $Frame_{i*}$;

(E) calculating the center of mass for $Frame_{i*}$ by dividing the vector sum of all position vectors corresponding to all of the overlapping points in $Frame_{i*}$ with the number of said position vectors corresponding to all of said overlapping points in $Frame_{i*}$;

(F) calculating a cross-vector for every overlapping point in $Frame_{i*}$ by performing a cross-product operation of (1) the position vector for the overlapping point in $Frame_{i*}$ substracted by the vector of the center of mass for $Frame_{i*}$ and (2) said minimum distance vector for the overlapping point in $Frame_{i*}$;

(G) calculating a sum of all the cross-vectors corresponding to all of the overlapping points in $Frame_{i*}$;

(H) applying a weighting factor to the sum of all of said cross-vectors for $Frame_{i*}$ thereby producing a weighted sum of all the cross-vectors for $Frame_{i*}$; and

(I) scaling the weighted sum of all the cross-vectors for $Frame_{i*}$ with an empirical acceleration factor f thereby creating a scaled weighted sum of all the cross-vectors for $Frame_{i*}$ thereby said scaled weighted sum of all the cross-vectors for $Frame_{i*}$ forming the rotation transformation matrix $[T](R)_i$.

(v) applying the transformation to $Frame_i$ and evaluating the results comprising the sub-steps of:

(A) computing the transformation matrix for $Frame_i$ $[T]_i = + [T](t)_i + [T](R)_i$; and applying the transformation matrix $[T]_i$ to every point in $Frame_i$ thereby producing a transformed $Frame_i$ wherein $[T](t)_i$ produces the transalation of the X, Y and Z coordinates of every point in $Frame_i$ and $[T](R)_i$ produces the magnitude and direction of rotation of $Frame_i$;

(B) calculating the closeness factor of the transformed $Frame_i$ and $Frame_{i-1}$ and comparing said closeness factor with the quality index;

(C) if the closeness factor > the quality index, then returning to step (iii); otherwise proceeding to the next step;

(D) if $i < N$, setting $i = i + 1$ and returning to step (ii) until $Frame_N$ is registered.

The applicants' remarks in support of amended claim 43 are analogous to those presented in support of claim 1. The method claim 43 has been amended to disclose in detail a very important aspect of constructing a virtual three-dimensional model of an object from frames, namely the process of frame to frame registration in the sub-steps of step (d). The novel sub-steps provide the details concerning (i) transformation of the Z coordinates, (ii) calculation of the translation matrix, (iii) calculation of the rotation transformation matrix; and their application in transforming a frame for registering it to

another frame. The support for the amendment to claim 43 comes from page 65, line1 - page 73, line 3 and Figures 40A - 40D of the specification. In order to fully appreciate the novelty of frame to frame registration as a very important component of constructing a virtual three-dimensional model of an object one must examine the detailed sub-steps of amended claim 43. Zhang does not teach or disclose the registration process used in constructing a virtual three-dimensional model of an object disclosed in claim 43. The applicants submit that amended independent claim 43 is novel over and not anticipated by Zhang.

In view of the above remarks, the anticipation rejection under 35 U.S.C. 102(e) of claim 43 should be withdrawn.

Regarding claim46, claim 46 depends from independent claim 43. The applicants respectfully submit that in view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the anticipation rejection under 35 U.S.C. 102(e) of claim 46 are moot; and request that the anticipation rejection under 35 U.S.C. 102(e) of claim 46 should be withdrawn.

Regarding claim 47, the applicants have canceled claim 47.

Regarding claim 48, claim 48 depends from independent claim 43. The applicants have amended claim 48 in view of the amendment made to claim 43. The applicants respectfully submit that in view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the anticipation rejection under 35 U.S.C. 102(e) of claim 48 are moot; and request that the anticipation rejection under 35 U.S.C. 102(e) of claim 48 should be withdrawn.

Regarding claim 49, the applicants have canceled claim 49.

Regarding claims 50, 52-54 and 58-60, each of claims 50, 52-54 and 58-60 depends from independent claim 43. The applicants have amended claims 50, 52 and 53 in view of the amendment made to claim 43. The applicants respectfully submit that in

view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the anticipation rejection under 35 U.S.C. 102(e) of claims 50, 52-54 and 58-60 are moot; and request that the anticipation rejection under 35 U.S.C. 102(e) of claim 50, 52-54 and 58-60 should be withdrawn.

35 USC § 103 Rejections

Claims 6 and 51

The Examiner has rejected claims 6 and 51 under 35 U.S.C. 103(a) as being unpatentable over Zhang.

Regarding claim6, claim 6 depends from independent claim 1. Applicants have amended claim 6 in view of the amendment to claim 1. The applicants respectfully submit that in view of the amendment to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claim 6 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claim 6 should be withdrawn.

Regarding claim51, claim 51 depends from independent claim 43. Applicants have amended claim 51 in view of the amendment to claim 43. The applicants respectfully submit that in view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claim 51 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claim 51 should be withdrawn.

Claims 8 and 53

The Examiner has rejected claims 8 and 53 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of USPN 6,078,701 to Hsu et al. ("Hsu").

Regarding claim8, claim 8 depends from independent claim 1. Applicants have amended claim 8 in view of the amendment to claim 1. The applicants respectfully submit that in view of the amendment to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claim 8 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claim 8 should be withdrawn.

Regarding claim53, claim 53 depends from independent claim 43. Applicants have amended claim 53 in view of the amendment to claim 43. The applicants respectfully submit that in view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claim 53 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claim 53 should be withdrawn.

Claims 10-12, 20, 41 and 55-57

The Examiner has rejected claims 10-12, 20, 41 and 55-57 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of USPN 5,257,203 to Riley et al. ("Riley").

Regarding claims10-12, each of claims10-12 depends, through one or more intervening claims, from independent claim 1. The applicants respectfully submit that in view of the amendment to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claims10-12 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claims10-12 should be withdrawn.

Regarding claim 20, the applicants have canceled claim 20.

Regarding claim41, claim 41 depends from independent claim 33. The applicants respectfully submit that in view of the amendment to independent claim 33 and the remarks presented above in support of withdrawing the anticipation rejection under 35

U.S.C. 102(e) of claim 33, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claim 41 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claim 41 should be withdrawn.

Regarding claims 55-57, each of claims 55-57 depends, directly or through one or more intervening claims, from independent claim 43. The applicants respectfully submit that in view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claims 55-57 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claims 55-57 should be withdrawn.

Claims 15 and 16

The Examiner has rejected claims 15 and 16 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of US Patent Application Pub. 2001/0043738 to Sawhney et al. ("Sawhney").

Regarding claims 15 and 16, each of claims 15 and 16, directly or through an intervening claim, depends from independent claim 1. The applicants respectfully submit that in view of the amendment to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claims 15 and 16 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claims 15 and 16 should be withdrawn.

Claim 17

The Examiner has rejected claim 17 under 35 U.S.C. 103(a) as being unpatentable over Zhang and Swahney in view of Riley.

Regarding claim 17, claim 17 depends, through intervening claims, from independent claim 1. The applicants respectfully submit that in view of the amendment

to independent claim 1 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 1, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claim 17 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claim 17 should be withdrawn.

Claims 34 and 35

The Examiner has rejected claims 34 and 35 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of USPN 6,434,265 to Xiong et al. ("Xiong").

Regarding claims 34 and 35, each of claims 34 and 35 depends, directly or through an intervening claim, from independent claim 33. The applicants respectfully submit that in view of the amendment to independent claim 33 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 33, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claims 34 and 35 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claims 34 and 35 should be withdrawn.

Claims 44 and 45

The Examiner has rejected claims 44 and 45 under 35 U.S.C. 103(a) as being unpatentable over Zhang in view of US Patent Publication 2003/0169913 to Kopelman et al. ("Kopelman").

Regarding claims 44 and 45, each of claims 44 and 45 depends from independent claim 43. The applicants respectfully submit that in view of the amendment to independent claim 43 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 43, the Examiner's grounds for the obviousness rejection under 35 U.S.C. 103(a) of claims 44 and 45 are moot; and request that the obviousness rejection under 35 U.S.C. 103(a) of claims 44 and 45 should be withdrawn.

Allowable Subject Matter

Claims 37-40

Claims 37-40 are objected to as being dependent upon a rejected base claim, but would be allowable if written in independent form including all of the limitations of the base claim and any intervening claims.

Regarding claims 37-40, each of claims 37-40 depends, through one or more intervening claims, from independent claim 33. The applicants respectfully submit that in view of the amendment to independent claim 33 and the remarks presented above in support of withdrawing the anticipation rejection under 35 U.S.C. 102(e) of claim 33, claims 37-40 should be allowed.

Favorable consideration of the application and allowance of all claims is requested.

Respectfully submitted.

Date: 18 March 2005 By: Jasvantrai C. Shah

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CERTIFICIATE OF MAILING

The undersigned hereby certifies that the foregoing Amendment is being deposited as first class mail, postage prepaid, in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria VA 22313-1450, on this 18 th day of March, 2005.

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